Endowment effect and the gap between WTP and WTA

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August 2019

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August 29, 2019

Abstract

I used an auction experiment in China and confirmed that there is a WTP-WTA gap. I used the solemn oath commitment device and found that it reduces the gap in the long possession treatment. However, the gap still exists in the short possession treatment. The evidence suggests that taking an oath to tell the truth with an incentive-compatible mechanism could mitigate the WTP-WTA gap.

Key Words: Endowment effect; WTP-WTA gap; Oath
JEL Codes: C91, D46

*I'd like to thank Kuoping Chang for the helpful discussions on this paper. I would also like to express my appreciation to Nan Zhang and Xuelu Wei for their help with the experiments. Haoyan Chen provided excellent research assistance for the data analysis. Funding for this project was provided by China's Postdoctoral Science Fund # 2017M613089.

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1 Introduction

The disparity between willingness to pay (WTP) and willingness to accept (WTA) is a controversial topic in economics. The minimum WTA is often found to be larger than the maximum WTP. When a consumer has a smooth preference and there is little wealth effect present, WTP and WTA should theoretically be equivalent (Willig (1976)). However, many empirical studies have found that there is a large disparity between WTP and WTA standards (Knetsch and Sinden (1984); Horowitz and McConnell (2002); Tunel and Hammitt (2014)). Tunel and Hammitt (2014) uses a meta-analysis on WTP and WTA and finds that the disparity is especially large for public goods and non-market environmental goods. They also find that disparity decreases with the participants' market experiences.

Two main theories could explain the disparity between WTP and WTA. The first one is the endowment effect, which suggests that people value goods more when they possess it. This is also called loss aversion, which denotes that losses are deemed to be more painful than gains. To give up something, people tend to require more compensation (WTA) than the amount they would be willing to pay to get it (Kahneman and Tversky (1979)). The endowment effect has been tested and finds supports for this claim(Knetsch and Sinden (1984);Boyce et al. (1992);Kahneman et al. (1990)). The other theory is the substitution effect, which was proposed by Hanemann (1991). If there are fewer substitutes, people will want to get more compensation to give up some goods as compared to the amount they are willing to pay for the goods. This is true for environmental goods, such as clean air and water as there are few substitutes. Some empirical studies which have utilized candy bar and sandwich auctions in the lab have found support for this theory (Shogren et al. (1994);Shogren et al. (2001)). A more comprehensive review of other possible theories for the disparity between WTP and WTA can be seen in Marzilli Ericson and Fuster (2014).

A few recent studies have cast doubt on the robustness of the disparity between WTP and WTA. List (2003) uses a sports card field experiment and finds that a gap exists among inexperienced traders but not among dealers. This study argues that the gap can be eliminated through market

experiences. Plott and Zeiler (2005) argues that the gap is artificial and is created by the subjects' misunderstandings of the experiment protocols. Isoni et al. (2011) repeats Plott and Zeiler (2005)'s experiment and finds similar results for the mug experiment. However, the gap between WTP and WTA was still found to exist for the lottery experiment, even after repeated market transactions. Kszegi and Rabin (2006) proposes an expectation-based reference point theory, and this theory can explain List (2003)'s findings well, as dealers do not expect to own sports cards and do not experience endowment effect. Some studies have also tested Kszegi and Rabin (2006)'s theory through the use of lab experiments and have found mixed evidence both for and against it. (Marzilli Ericson and Fuster (2011);Heffetz and List (2014)).

This paper will thus look towards testing the robustness of the endowment effect using a commitment device: the solemn oath. The seminar paper by Jacquemet et al. (2013) uses an oath as a commitment device to elicit the subjects' preferences. They find it can eliminate the hypothetical bias and also solve the participation constraint non-binding problem in a real auction. The effect of the oath has been tested by other researchers with the choice model, public goods provision, contingent valuation studies, referendum BDM, and coordination with success(Stevens et al. (2013); De Magistris et al. (2016); de Magistris and Pascucci (2014); Jacquemet et al. (2017);Carlsson et al. (2013);Jacquemet et al. (2015)). de Magistris and Pascucci (2014) uses a hypothetical choice experiment for a private good and finds that the oath can reduce the participants' WTP. Stevens et al. (2013) uses a referendum for public goods contribution under a BDM mechanism and finds that the oath successfully reduces hypothetical bias. Jacquemet et al. (2017) also confirm the effect of the oath in eliminating any hypothetical bias under a referendum. In addition, Jacquemet et al. (2015) finds that the oath can solve any coordination problems in a game. Some researchers have studied the oath in field studies beyond the lab and find that the effect of the oath is related to culture and socioeconomic characteristics. Carlsson et al. (2013) has studied the effect of oath with a CVM study in both China and Sweden. They find that the oath reduces subjects' WTP for climate change mitigation in China but increases the subjects' WTP in Sweden. De Magistris et al. (2016) find

the effect of the oath is also related to the participants' socio-demographic characteristics, such as education and income.

Previous literature, such as Plott and Zeiler (2005), argue that the preference elicitation format can be the source of the disparity between WTP and WTA. Many previous studies regarding the WTP and WTA gap use a hypothetical survey (Kahneman et al. (1990), while other studies use an incentive-compatible mechanism, such as BDM. However, Cason and Plott (2014) has shown that misperception of the experiment can lead to biased results. They find the BDM mechanism of eliciting preferences is not reliable, as subjects can mistake the second price auction incentives of the BDM for the first-price auction. They argue the disparity of WTP and WTA can come from the misconception of the form of the game rather than their preference. More training and experience with the game would thus help reduce the gap (Plott and Zeiler (2005); Engelmann and Hollard (2010)).

I use the oath device to test if it can eliminate the WTP and WTA gap. The oath can increase the subjects' cognitive efforts and help avoid the misconception of the game form. In addition, I have two training rounds to allow subjects to understand the incentive-compatibility of the BDM. The real bidding is sectioned into four rounds to give the subjects more experiences. In addition, I follow Plott and Zeiler (2005)'s instructions to avoid giving the subjects any misconceptions with regards to the instructions.

I also vary the experiment design by changing the reference state. In two groups, subjects are allowed to keep the endowment during the experiment. In the other two groups, subjects do not possess the endowment at the time of the decision. This difference creates a strong reference state and a weak reference state, respectively. Knetsch and Wong (2009) create weak and strong reference states through manipulation of ownership, physical possession, and wording of the trade. They find that physical possession in combination with wordings, such as "give up" or "keep" create the strongest endowment effect. However, the ownership at the time of decision does not affect the endowment effect. In total, 158 students participated in the experiment. Among them, 100 participants were male and 54 were female. 4 participants did not fill out the questionnaire about socio-economic characteristics and consequently, I do not have any information about their gender.

My results show there is a significant gap between WTP and WTA among the four groups, except one. Taking an oath eliminates the gap in the long possession group, while the oath does not eliminate the gap in the no-possession group. I find the no-possession group has a stronger endowment effect than the long possession group. The result is different from Knetsch and Wong (2009). As such, the findings can contribute to the literature on the robustness of the WTP-WTA gap.

2 Experiment Design

The experiment was carried out at Xi'an Jiaotong University, China. I place a bulletin board on campus to recruit participants. The baseline is a long possession without the oath. The other three treatments are long possession with an oath, short possession without an oath, and short possession with an oath. The experiment design is in table 1. Plott and Zeiler (2005) argues that the misconception of the experimental procedure can lead to the WTP-WTA gap. It is thus essential to follow the best practice to address these potential misconceptions. I followed Plott and Zeiler (2005)'s procedure and used the following procedures to ensure that there was no misconception of the game: 1) randomization for the buyer and seller of the candy bar; 2) using incentive-compatible mechanism BDM to elicit the subjects' preferences; 3) explanation of the optimal response with numerical values; 4) using a market environment with some incentives; 5) measuring the gap directly by using valuations; 6) providing practice rounds.

After subjects enter the classroom, I randomly divided them into two groups of buyers and sellers, according to the odd and even last digit of each subject's student id number. Each subject is asked to choose a desk with instructions on it. They are then asked to sign the consent form. I collect all the forms once they finish. An experimenter reads the instruction aloud so everybody can follow it. Subjects are also welcome to ask questions and are informed that the experimenter will answer their questions. An induced value experiment with two rounds is used to help subjects understand the incentive-compatibility of the BDM mechanism. Subjects are explicitly told that the dominant strategy is to bid truthfully and strategic behavior would

not be in their best interests. After the training, subjects participate in the real experiment. Sellers of candy bars are asked to state their minimum WTA to sell the candy bars and buyers are asked to state their maximum WTP to buy the candy bars. There are four rounds. After each round, a random number that is between 1 to 15 is drawn and the market price is determined. Sellers whose WTA is lower than this price have to sell candy bars at this price. Buyers whose WTP is larger than this price have to pay this amount to buy candy bars. After four rounds, a random number between 1 to 4 is drawn to determine which round is binding. Socioeconomic data was then collected after the experiment. Subjects receive 30 Yuan as the participation fee. An on-campus job in Xi'an is usually paid 8 Yuan /hour. If they sell the candy bar as sellers, their earnings would be equal to the participation fee plus the market price. If they buy the candy bar as buyers, their earnings equal the participation fee minus the market price. Subjects are paid through electronic transfer to their bank accounts after the completion of the experiment.

The subjects with oath treatments are the same as those without oath treatment, with the exception of the subjects being asked to sign an oath script before the commencement of the experiment. The oath script is presented in Figure 1. In the possession treatments, subjects are allowed to keep the candy bar during the experiment. However, in the without-possession treatment, subjects do not physically possess the candy bar at the time of decision. At the beginning of the experiment, a few candy bars are passed around for subjects to inspect before the candy bars are collected again. As such, the subjects do not physically possess the candy bar at the time of decision. In all treatments, the sellers own the candy bar.

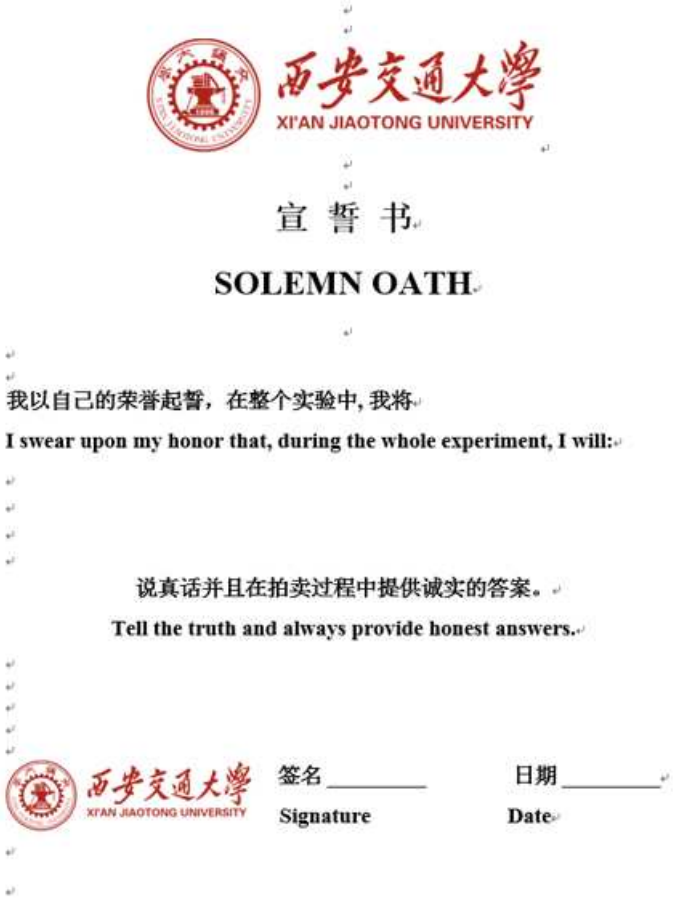
3 Data and Results

3.1 Summary Statistics

In the baseline group, the average WTP and WTA are 6.13 Yuan and 7.4 Yuan, respectively. In the short treatment without oath, long treatment with an oath, and short treatment with an oath, the average WTP is 5.9, 5.3, 5.5

Table 1: Experiment Design

	Practice rounds	Commitment	Elicitation Mechanism	Number of rounds	Payment
Baseline-long without oath	2		BDM	4	random round
Short without oath	2		BDM	4	random round
Long with oath	2	X	BDM	4	random round
Short with oath	2	X	BDM	4	random round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宣 誓 书

SOLEMN OATH

我以自己的荣誉起誓，在整个实验中，我将

I swear upon my honor that, during the whole experiment, I will:

说真话并且在拍卖过程中提供诚实的答案。

Tell the truth and always provide honest answers.

西安交通大學
XI'AN JIAOTONG UNIVERSITY

签名 _____ 日期 _____

Signature Date

Figure 1: oath script

Yuan, respectively; and the average WTA is 7.8, 6.4, 8.25 Yuan, respectively. The summary statistics are in table 2.

Table 2: Summary statistics

	Baseline		non-possession without oath		possession with oath		non-possession with Oath	
	wtp	wta	wtp	wta	wtp	wta	wtp	wta
Mean	6.14	7.40	5.93	7.80	5.30	6.41	5.48	8.25
Median	5.75	7.75	5.75	8.00	4.50	7.00	5.75	9.00
Standard Deviation	2.05	2.51	2.25	2.07	2.16	3.00	1.34	3.03
n	31	23	22	15	15	17	15	20

3.2 Results

Result 1 There is a disparity between WTA and WTP, and WTA is significantly greater than WTP.

Support. From table 2 we see WTA is larger than WTP in each treatment. From Figure 1-4, we can see in each treatment that the WTA distribution strictly dominates the WTP distribution. The Wilcoxon rank-sum test rejects the null hypothesis that WTP and WTA are drawn from the same population in both the baseline and short-without oath treatment ($z = 1.936, p = 0.0529$, and $z = 2.419, p = 0.0156$, respectively). The median test also rejects the null hypothesis that the medians are drawn from two populations that have identical medians for the baseline (Pearson $\chi^2 = 5.9425, p = 0.015$). However, it fails to reject the null for the short treatment without an oath (Pearson $\chi^2 = 1.1675, p = 0.280$).

Result 2. With a solemn oath, the disparity between WTP and WTA in the long possession group disappears. However, it persists in the short possession group.

Support. In the long with oath treatment, I find that the gap between WTP and WTA is statistically insignificant. Using the Wilcoxon rank-sum test, I fail to reject the null hypothesis that WTP and WTA are drawn from an identical population ($z = 1.211, p = 0.226$). The median test fails to reject the null hypothesis that the two independent samples are drawn from populations with the same medians ($\chi^2 = 0.000, p = 1.000$). In the short-with oath treatment, I find that the gap between WTP and WTA is significant.

The Wilcoxon rank-sum test rejects the null hypothesis that the WTP and WTA are drawn from the identical population ($z = 3.154, p = 0.002$). The median test rejects the null hypothesis that the two independent samples are drawn from populations with the same medians ($\chi^2 = 6.6936, p = 0.010$).

Result 3. The short possession endowment increases the disparity between the WTP and WTA.

Support. I calculate the gap in each round by using the average WTA minus the average WTP. In the baseline, the gaps in the four rounds are {1.228, 1.228, 1.228, 1.088}. The gaps in the four rounds of short- without oath treatment are {2.142, 1.996, 1.372, 1.960}. The gaps in the long-with oath treatment are {1.282, 1.270, 0.909, 0.984}. The gaps in the short-with oath treatment are {2.583, 2.65, 2.883, 2.95}. I pool the two treatments with short possession and the two treatments with the long possession. Using the Wilcoxon signed rank test, I reject the null hypothesis that the two independent samples are drawn from identical populations ($z = -2.380, p = 0.0173$).

I also use individual round data and find the same results. The subjects' bids are relatively stable across four rounds.

Table 3: Statistical test results

	Wilcoxon-Mann-Withney rank sum test (Null hypothesis: identical distribution)			Median test (Null hypothesis: populations have identical medians)		
	z	p-value	Conclusion ($\alpha = 0.05$)	Pearson χ^2	p-value	conclusion ($\alpha = 0.05$)
Baseline-long without oath	1.936	0.0529	fail to reject null	5.9425	0.015	reject null
Short without oath	2.419	0.0156	reject null	1.1675	0.28	fail to reject null
Long with oath	1.211	0.226	fail to reject null	0	1	fail to reject null
Short with oath	3.154	0.002	reject null	6.6936	0.01	reject null

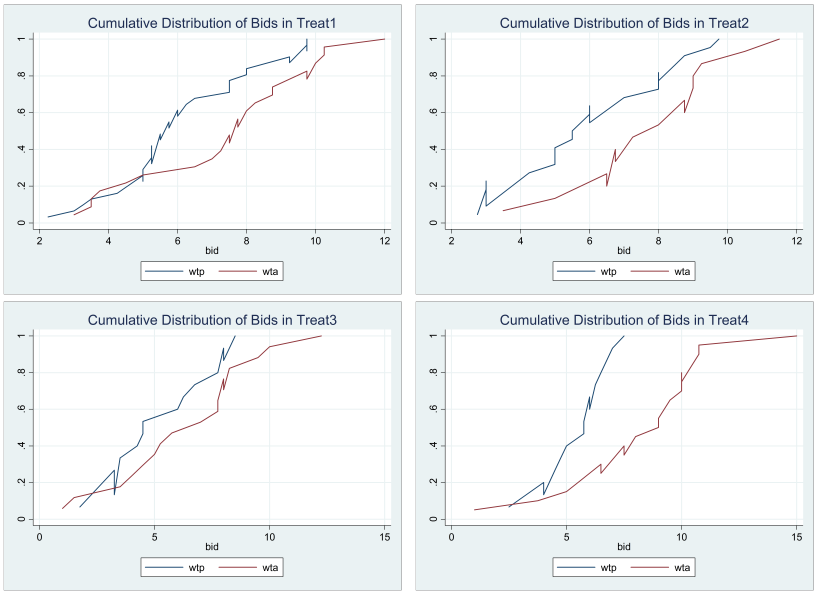

Figure 2: Empirical Distribution Functions of bids: treat1–baseline; treat2–short without oath; treat3–long with oath; treat4–short with oath

4 Discussion and Conclusion

Recent studies have cast doubt on the robustness of the disparity between WTP and WTA. They argue the gap can stem from subjects' misconceptions of the game (Plott and Zeiler (2005);Cason and Plott (2014)). I follow the modified experimental procedures and found that there is a significant gap. In addition, I use the commitment device: a solemn oath, to increase the subjects' cognitive efforts towards telling the truth. The oath script works to reduce the gap in the long possession group. However, the gap still exists in the non-possession group. I also find the non-possession group has a significantly larger gap than the possession group. My evidence suggests that the physical possession of the good does not increase the subjects' valuation of the good. This lends support to Kszegi and Rabin (2006)' expectation-based endowment effect. Most of the tests on the disparity between WTP and WTA are conducted in the U.S. and other industrialized countries. Evidence suggests that subjects may behave differently across different cultures. In addition, Carlsson et al. (2013) find that subjects in China and Sweden

respond differently to a solemn oath in a CVM study. Ehmke et al. (2008) tests the hypothetical bias in different continents and finds that there are differences across cultures. As such, many other experimental studies use a broader subject pool to study the universal effect of behavioral bias (Henrich et al. (2001)). Apicella et al. (2014) studies isolated hunter-gathers group living in Northern Tanzania and found they do not show the endowment effect. The same population living in areas that are more exposed to modern society do not show the endowment effect. My evidence in China thus lends support to the universal effect of the endowment effect.

My study has some limitations. For one, I had a relatively small sample size. I also used student subjects in the lab to increase the control of the experiment. An avenue for future research can be in the study of the endowment effect in a field setting that has a more diversified subject pool.

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